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ABSTRACT

The scope, history, and effects of technological innovation in higher education in Japan, with particular attention to Tokyo Institute of Technology, are explored, and the developments leading to the present state of the technology are reviewed. An overview of the current status includes a listing of institutions with audiovisual equipment, a description of educational technology used in various colleges and universities, and plans for the University of the Air. Tokyo Institute of Technology's project on closed circuit television and a response analyzer are described, along with the studies of educational technology and its effects by the Center for Research and Development of Educational Technology. Obstacles to faster and further development of educational technology are identified. (SK)

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PRESENT STATE OF TECHNOLOGICAL INNOVATION IN HIGHER EDUCATION OF JAPAN

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PRESENT STATE OF TECHNOLOGICAL * INNOVATION IN HIGHER EDUCATION OF JAPAN

TAKASHI SAKAMOTO**

1. Technological innovation in Education of Japan

In Japan it is since 1968 that the technological innovation in education has been widely studied and discussed in terms of educational technology.

(1) A short history of technological innovation in education.

1) Education by film

Since 1920's, the cultural films had been introduced to schools and projected to many pupils in the auditoriums. After the end of World War II, thousands of 16mm film projectors and educational movie films were distributed to the local boards of education by the US Army. By virtue of support from USA, the education by films prevailed all over Japan. This situation had encourage not only Japanese film producer to develop many educational films but also school teachers to utilize these films in their classrooms. This trend has been continuing even after 1968.

2) Education by Radio and TV.

The radio broadcasting started in 1925, when Mr. Shimpei Goto, the first president of Tokyo Broadcasting Organization, emphasized in his address cerebrating the opening of the radio station the importance of four educational functions which the broadcasting should have -----the equal chance for culture, the innovation in home life, the socialization of education, and the activation of the function. Since then, the education by broadcasting has been regarded as one of the most important media for the school education and the out-of-school education.

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* A part of this paper was presented in the 18th International Congress of Applied psychology, in Montreal on 1st August, 1974

** Educational Methods, Department of Education.

Now NHK, Japan's sole public service broadcaster, has 2 TV and 2 Radio service networks, each one of which is specialized in education and cultural programs, and broadcasts nation-wide educational programs for 126 hours a week on educational TV network and radio programs for 122 on the 2nd radio network.

3) Development and Utilization of Educational Equipments.
The development and utilization of Audio-Visual devices and equipments followed the education by film and broadcasting, and many kinds of devices and equipments were introduced to the classrooms by a rather limited number of teachers.

4) Introduction of the Skinnerian type of programmed Learning.
In 1962 and 1963, school teachers and instructors in private enterprises became much interested in the Skinnerian type of programmed learning, because it was believed to lead to the effective learning. This movement built the pavement for the introduction of the educational technology to the school education and the education in industry.

5) Modernization of Curriculum Development.
New curricula such as PSSC, CHEMS, SMSG, and BSCS were introduced to Japan to stimulate the innovation in education from the aspect of educational contents.

6) "Technology in Education", hearings before subcommittee in Economic Progress, at the Congress in USA.
The description and comments of the hearings, "Technology in Education" before subcommittee on Educational Progress at the US congress, are assumed to have direct influence upon the arising of a great deal of interests in educational technology in Japan.
Since then, the educational technology has been discussed as one of the main themes in various educational magazines and in the national conferences related to education.

(2) Present State of Educational Technology in Japan.

In the present situation, to be noted are the following.

1) The annual meetings of audio-visual education and Radio-TV education.
In the annual conventions of the National Association of Audio-Visual Education and the National Association of Radio and TV Education,

the problems of technological innovation in education have been taken up as one of the main themes annually for last several years and have had a great deal of influence upon those teachers who participated in these meetings.

2) Publication of Magazines on Educational Technology.
Several specialized magazines on the educational technology have been published for school teachers who have much interest in the improvement of instruction. Notable and influential ones are Audio-Visual Education, Radio-TV Education, Contemporary Educational Technology, Instructional Systems, and Instructional Technology. All of them are not purely accademic journals.

3) Educational Technology in Academic Societies.
The researches on the technological innovations in education are reported in many conventions of related accademic societies, i.e., the Japanese Association of Educational Psychology, Japanese Society for the Study of Education, Japan Society for the Study of Audio-visual Teaching Aids, Japan Society for the Study of Educational Radio and TV. Particularly it is quite interesting that the monthly meeting of educational technology section in the Institute of Electronics and Communication Engineers of Japan is the most active one. Ten or more papers are monthly reported there and they amounted to 700 pages a year.
The main problems discussed in this section are the utilization of images in education, the utilization of computers in education, the assessment of instruction, training-simulators and so on.

4) Researches on Utilization of Educational Equipment in the schools designated and supported by the Ministry of Education.
The Ministry of Education designated 22 junior high schools in 1969, and 22 primary schools in 1970 to study the effective use of educational equipments for three years.
These activities stimulated the local boards of education to designate schools under their jurisdiction to study this particular problem, and to increase the budget for purchase of educational devices and equipments.
During this period, schools have generally and gradually changed their research themes from the effective use of equipments to systematic approach to designing, carrying out and evaluating the teaching-

learning process including the use of devices and equipments as a part of the system.

5) Growth in the Number of Educational Devices and Equipments in Schools and other Educational Institutions.

Accompanying with these activities, the growth has been remarkably great in the number of educational devices and equipments in the educational institutions, as is shown in Table 1.

Figure 1 shows the map of the quotients for technological innovation in education of each prefecture in Japan, which were obtained by multi-variate analysis on 13 important devices and equipments selected out of those shown in Table 1 i.e., OHP, Sheet type recorder (talking page), VTR, CCTV, Response Analyzer, LL and so on.

The quotients are high in the prefectures with large cities in terms of population.

Figure 1

(1) Quotient of Technological innovation in Education

(1972)

Figure 1

(2) Quotient of Technological Innovation in Education (1972)

1	AICHI	2.663	25	TOKUSHIMA	-0.146
2	KAGAWA	2.381	26	GUNMA	-0.180
3	TOKYO	2.002	27	NAGANO	-0.195
4	NARA	1.424	28	GIFU	-0.206
5	NAGASAKI	1.298	29	OKINAWA	-0.360
6	OOSAKA	1.293	30	ISHIKAWA	-0.387
7	CHIBA	1.195	31	YAMANASHI	-0.480
8	KANAGAWA	1.076	32	IWATE	-0.655
9	OKAYAMA	0.863	33	FUKUOKA	-0.699
10	TOTTORI	0.807	34	IBARAGI	-0.700
11	HYOOGO	0.749	35	SAITAMA	-0.70
12	MIYAGI	0.692	36	KUMAMOTO	-0.708
13	TOYAMA	0.687	37	SAGA	-0.736
14	FUKUI	0.552	38	KOOCHI	-0.899
15	YAMAGUCHI	0.238	39	KAGOSHIMA	-0.955
16	SHIGA	0.184	40	WAKAYAMA	-1.005
17	YAMAGATA	0.175	41	MIYAZAKI	-1.053
18	HIROSHIMA	0.117	42	MIYE	-1.096
19	EHIME	0.112	43	AOMORI	-1.207
20	NIIGATA	0.086	44	HOKKAIDO	-1.236
21	KYOOTO	-0.071	45	SHIMANE	-1.372
22	FUKUSHIMA	-0.091	46	AKITA	-1.390
23	TOCHIGI	-0.102	47	OOITA	-1.852
24	SHIZUOKA	-0.105			

Table 1. Audio-visual Equipment in Educational Institutions

(May, 1972)

Equipments \ Institutions	Kindergarten	Elementary schools	Lower secondary schools	Upper secondary schools	Community centre	Prefectural library	Municipal library	Museum	Educational institutes for youth	Educational centre for women
Overhead projector	84.0%	93.5%	84.6%	78.1%	51.7%	37.5%	16.5%	29.7%	71.6%	42.3%
TV receiving set (mono)	4.8	86.4	96.7	93.2	15.4	31.3	5.5	9.9	25.3	11.5
TV receiving set (color)	33.4	30.8	18.9	25.4	25.7	16.7	5.7	9.9	46.2	38.5
Video tape recorder	3.5	6.7	25.7	65.2	11.9	25.0	2.4	4.9	12.6	11.5

6) Standard Curriculum for in-service Training of Audio-Visual Education.

In March 1973, to the Minister of Education, the committee on Educational Broadcasting in the Council on Out-of-School Education in Ministry of Education, proposed the Standard Curriculum for in-service training of Audio-Visual Education in order to promote the use of audio-visual media in Out-of-School education and school education.

The proposed curriculum aims at a systematic improvement in in-service training in order to induce easier and wider use of audio-visual media in the actual teaching.

The contents of training were divided into three grades, i.e., elementary grade for all school teachers, out-of-school education consultants, consultants in charge of community centers, audio-visual library personnels and leaders of educational research organization, and advanced grade for those who play a leading role in audio-visual education.

Recently, in-service training courses have been increasingly provided in many prefectures, based on the standard curriculum and have been enhancing drastically the teaching abilities on educational technology.

7) International Seminars of UNESCO and CERI

In December 1973, an Asian Seminar on the application of Educational Technology was held by the Japanese National Commission for UNESCO in Tokyo. The purpose of the seminar was to enable the participants to have a chance for studying and examining problems and new approaches concerning the application of educational technology to the conditions in Asia. Twenty chief participants from 18 Asian member states attended the seminar.

In March 1974, an international seminar on the curriculum development was held by CERI (Center for Educational Research and Innovation) of OECD in Tokyo.

The role of Educational Technology in Curriculum development was dealt as one of the sub-themes. Discussions about the development of new methods and their limitations arose much interests in participants, which contents were reported in news papers and magazines.

2. The Technolocical Innovation in Higher Education of Japan.

(1) The technological innovation in co.leges and universities.

In Japan, the studies on the application of the educatio.-l technology have not be.n yet so much done in colleges and universities as in primary and secondary school education.

However, the educational technology centers have been established in 10 teacher training colleges since 1971 and set out to study on educational technology. The main themes are on the utiliz.tion of com.uter in education such as CMI and CAI, the observation and analysis of classroom teaching by CCTV.

Recently Nagasaki University started to establish the NIGHT system. At first, the university sends the educational materials to the primary and junior high schools in several remote islands by means of Facsimile. Then, schools utilizes them in the classrooms, gain the data of pupil's responses in forms of punched tapes, and sends them back to Nagasaki by telex. The data are processed by Computer in the university and sent back again to the schools by mail or facsimile.

Most of studies in these Educational Technology Centers, however, are mainly related on the analysis of the classroom teaching at primary and secondary school levels.

Only a few are concerned with the application of educational technology in higher educatic.n, i.e., the research for micro-teaching in Tokyo university of libe.al arts and science and the development of CAI for French in Aich university of education. Even these activities are staying on the experimental phases. Also in other several universities, more researches on educational technology are being carried out than at the educational technology centers attached to the national universities.

For example, there have been done researches on CAI in Osaka University and Tokyo University of Science, on the Response Analyzer and CMI in Keio University, on services from ERIC tapes and AVE in ICU

Most of them are also concerned with either the pure research activities or the instructional processes in p.imary and secondary school levels. These are not always applying the educational innova-.ion to higher education.

Though the experiences on the applicatio. of educational technology are quite few in Japan, a few universities, i.e., Universities of Elec-

tricity, Tokai University, Waseda University and University of Electricity and Telecommunication, are carrying out such activities well.

Most of them are related with the improvement of instruction by means of CCTV. In the University of Electricity and Telecommunication, a professor in the monitor room, observes the students in the experimental laboratory to instruct and answer the questions through the microphone and TV camera which can move around on the ceiling of the experimental laboratory in order to catch the student's behaviors exactly.

(2) Educational Innovation in In-service Training for Industrial Education.

In vocational in-service training education at the university level, the use of CAI is considered to be effective. For example, in the Central School in NTT, the learning by CAI are being executed of the 30 terminals in order to teach the technical employees how to write the FORTRAN and the Assembler language. In Japanese Society for the promotion of Machine Industry, the employees from various industries are learning several subjects at 30 terminals.

Programs used are FORTRAN, COBOL, APT, NC and so on.

(3) Plan of the university of the air in Japan.

The plan of the university of the air in Japan started in 1967. In March 1973, the basic plan was proposed, which emphasized the importance of instruction by means of communication media such as Radio and TV at the university level of education, in order to give the working employees and adults the occasions to study the higher education beyond the limitation of time, geography, and age.

The main features are the interdisciplinary curriculum development, the self learning in choosing their own specialities under the guidance of counsellors and instructors, the preparation for the variety of courses depending upon the various needs from students, and the schooling in regional centers.

For these 3 years, the experimental programs have been broadcast by TV from NHK UHF experimental station in Tokyo and Osaka and by Radio from Nippon Shortwave Broadcasting, which were composed of 4 TV programs and 4 Radio programs in each year.

The results of the studies on the effects in the use of the experimental programs are shown as below.

1) In answering the multiple-choice type of questions, the performance was not different between the group of those who are assigned to

review and the group of those who are not assigned to review. But in answering the short answer type of questions the performance was found to be better in the former group than in the latter group.

2) The percentages of those who found the improvement of their own performance were found to be higher in the studio learning group and talk back group than in the home learning group.

3) To the questionnaire, 110 out of 189 cases answered that questions and answers by telephone were found to be effective.

3. Technological Innovation of Education in Tokyo Institute of Technology.

Tokyo Institute of Technology is the University which has 2 faculties and 4 Research Institutes, and about 3500 undergraduate students, 916 graduate students, for Master's degrees, 332 graduate students for Doctor's degrees, and 1548 instructing staffs in 1973.

It was established in 1881. Since then it has much contributed to the development of the industries and technologies of Japan through the formation of many engineers and scientists.

The Institute has now 66 classrooms, including 13 classrooms where 20 OHPS are available at a time, 6 classrooms with CCTV two of which have RA, and 1 LL.

Though several professors had been trying to improve their lecture by using various audio-visual methods, it is since 1973 when the CRADLE was established that the technological innovation has really been introduced in Tokyo Institute of Technology.

(1) CCTV and Response Analyzer.

In 1968, a Response Analyzer and CCTV systems were introduced to a large lecture hall for the first time. Table 2 shows the effectiveness of the lecture of Professor SUETAKE at that time, who is now the Director of CRADLE.

Table 2 Effects of TV aids

Demonstration by TV	Disagreeable	13%	Average	16%	Interesting	71%
Pushing buttons for Response Analyzer	Unpleasant	5%	Unconcerned	20%	Interesting	75%
Lecture	Boring	15%	Average	30%	Interesting	55%

(2) Studies of Educational Technology in Center for Research and Development of Educational Technology (CRADLE).

The CRADLE has 1 Director, 2 Professors and 1 Associate Professor, and 1 Technician, and now is conducting researches on the development and the application of educational technology in the University.

The titles of researches are:

a. Development of Simple TM.

b. Introducing CCTV system into the instruction of drawing.

c. Design of the training room for Dictation Utilizing multi-speaker system.

d. Classroom Simulator for Teacher Training.

e. New System of Laboratory Works being self-conducted by students during the appointed period.

f. A New Multi patterns Transmitting System sending information of the lectures between the remote campuss utilizing Video-memories.

In the education for Physics, the purpose is the introduction of the technological innovation to individualize the laboratory works for Physics by auto-tutorial methods.

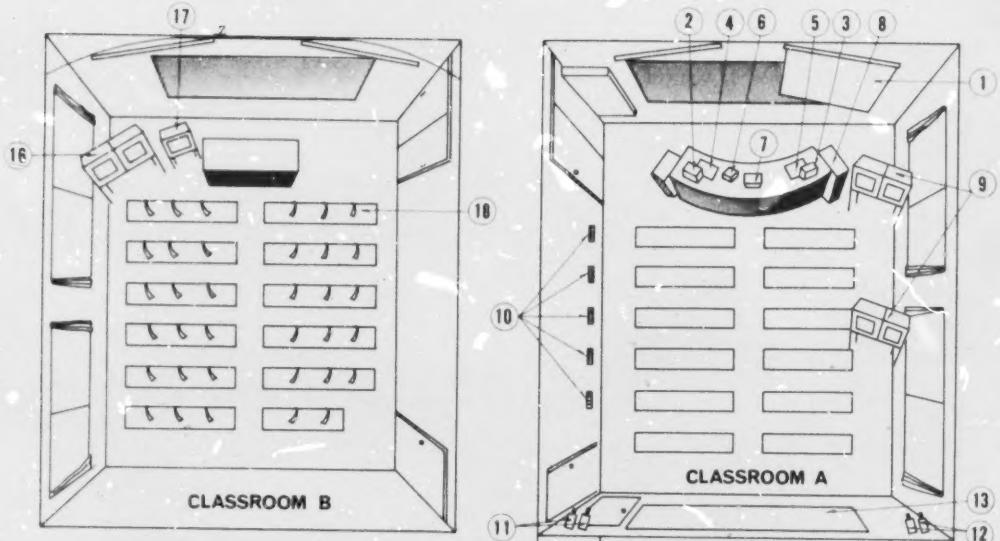
In the course of the design for drawing, a professor can ask and answer the questions from the students scattered in the remote sections of the design room by means of CCTV.

Especially interesting are the studies on the system which can present various kinds of instructional informations by means of TV communication technology in order to reduce the remote distance between 2 classrooms. Figure 2 shows the relationship between 2 classrooms.

In the classroom A, there are 2 sets of 2 TV monitors, 2 overhead cameras on the ceiling for sending the instructional materials upon the lecture desk, 4 cameras for catching the professor's behaviors and projecting them on the wall at the other side of the room and a simple response analyzer unit for evaluating and diagnosing student's responses.

In the classroom B, there are one set of 3 TV monitors and 35 microphones set on each student's desk. Through the auditory system, the professor and students in the classroom A can listen to the student who is speaking on his microphone in the classroom B.

Figure 2 Classrooms with educational devices and equipment



1 Screen
2 TV Monitor
3 TV Monitor
4 Material Presentation Table for overhead camera
5 Material Presentation Table for overhead camera
6 Main console for Simple Response Analyzer
7 Control panel for Speaker System
8 Table for OHP
9 TV Monitors
10 Terminal hooks for Simple Response Analyzer
11 TV cameras
12 TV cameras
13 Screen for Video Scope
14 Mirror for Video Scope
15 Projector for Video Scope
16 TV Monitors
17 TV Monitor
18 Microphones

Some researches are being conducted in these equipped classrooms in order to examine the effectiveness of instruction by means of TV communication technology.

(3) Effects of various types of TV images on the student learning.

Purpose: The main aims are to examine the effects of various types of TV images and to improve the education by the remote TV system.

Procedure: In the class for educational psychology, students are divided into 4 groups (Table 3 according to their own choice, that is,

Group a --- Those who can study at the presence of the professor in the same classroom and can see the instructional materials or the 2 TV monitors.

Group b --- Those who don't have a professor in their classroom, but can see the TV images of the professor in the other classroom and the same instructional materials on 2 other TV monitors as in Group a.

Table 3 Summary of Conditions in 4 Groups

Group	Condition		
	Professor	Instructional Materials	Voice
a	a professor	2 TV monitor for showing instructional materials	real voice of professor
b	1 TV monitor for showing the face of a professor	2 TV monitors for showing the same instructional materials as in Group a	professor from microphone
c	the same condition as in Group b, but any 2 out of 3 TV monitors showing the stop motioned images		the same as in Group b
d	no TV monitor for showing a professor	2 TV monitor for showing instructional materials	the same as in Group b

Group c --- Those who are studying in similar situation as in Group b, but have the different experiences for seeing any 2 out of 3 TV images as stop-motioned.

Group d --- Those who have no TV monitors for showing the image of the professor, but can see the same instructional materials as in Groups a and b on 2 TV monitors.

Group a studies in the classroom A, but either Group b, c, and d studies in the classroom B.

The instructional communication system used for Group c, which is recently developed by Professor Suetake and Mr. Okada et al. in CRADLE, is composed of 3 TV monitors, the video-memory unit and the switching unit, in the sending station, and 3 TV monitors in the receiving station.

When the sender sends 3 TV images to the receiver in the usual CCTV communication system, there should be necessary 3 channels each one of which is allocated for each one TV image. However, by this communication system, 3 kinds of TV images can be sent to the remote receiver only by 1 channel in forms of one moving and 2 stop-motioned images. Although 2 TV images are always stop motioned in this system, it is assumed to be useful to send lectures in the classroom, because in many lectures the stop-motioned information could send sufficient information especially concerning with the instructional materials from the sender to the receiver.

If necessary, the system can send the moving image which describe and point out the material with indicator, stopping the professor's

Table 4 Percentages of numbers of those who chose each Group

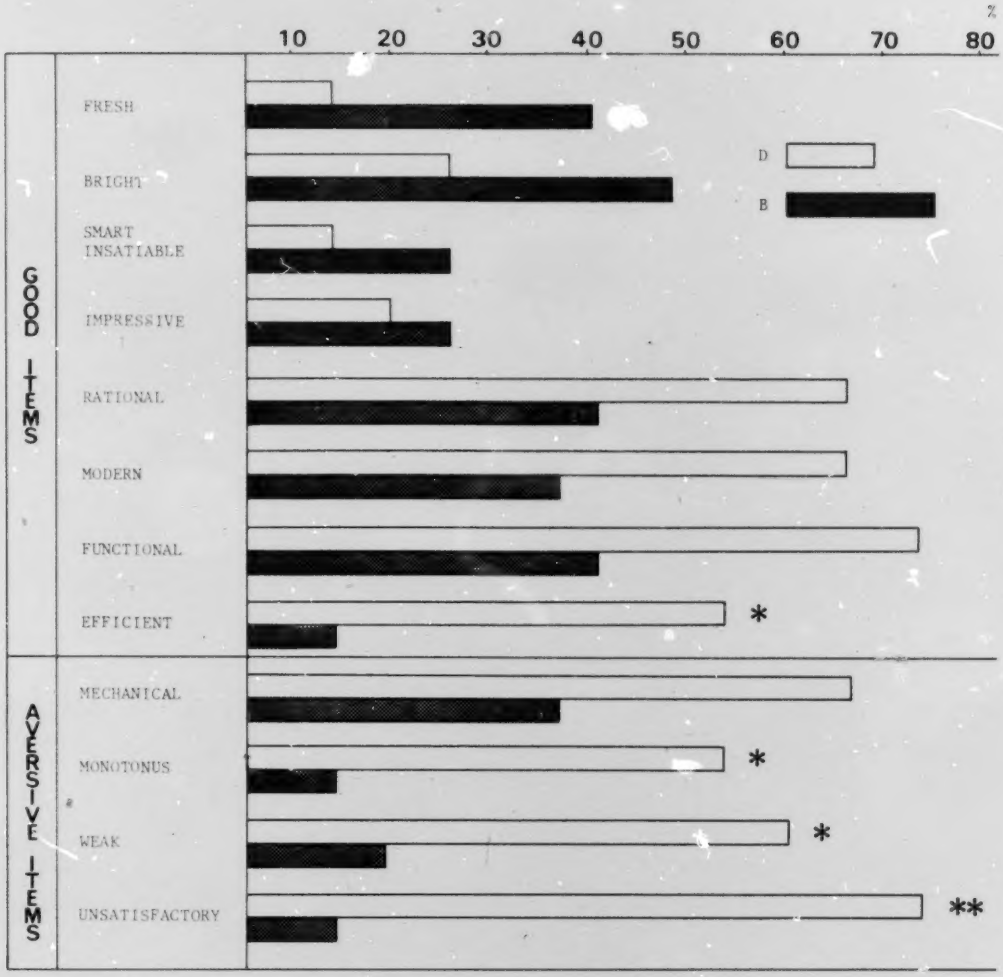
Group / Item	a Direct instruction	b TV with moving face	c TV with stop motioned face	d TV without face	a+b+c Instruction with face	b+c+d TV instruction
	36	27	18	15	81	60
bright %	55.6	48.1	44.4	26.7	50.6	41.7
modern	52.8	37.0	27.8	66.7	42.0	41.7
amusing	47.2	33.3	44.4	26.7	42.0	35.0
Impressive	44.4	25.9	11.1	20.0	30.9	20.0
smart	41.7	25.9	22.2	13.3	32.1	21.7
illustrative	41.7	22.2	33.3	13.3	33.3	33.3
functional	41.7	40.7	50.0	73.3	43.2	51.7
insatible	38.9	25.9	33.3	13.3	33.3	25.0
understandable	33.3	22.2	44.4	13.3	32.1	26.7
rational	25.0	40.7	27.8	66.7	30.9	43.3
fresh	25.0	40.7	16.8	13.3	28.4	26.7
free	25.0	33.3	22.2	33.3	27.2	30.0
efficient	19.4	14.8	22.2	53.3	18.5	26.7
condenced	11.1	14.8	16.8	33.3	13.6	20.0
Average	35.9	30.4	29.8	33.3	32.7	31.0
mechanical	44.4	37.0	44.4	66.7	42.0	46.7
restless	27.8	22.2	16.7	20.0	23.5	20.0
unsatisfactory	25.0	14.8	27.8	73.3	22.2	33.3
monotonous	22.2	14.8	22.2	53.3	19.8	26.7
weary	19.4	37.0	27.8	53.3	27.2	38.3
weak	19.4	18.5	16.7	60.0	18.5	28.3
sleepy	13.9	18.5	22.2	33.3	17.3	23.3
ugly	11.1	33.3	22.2	33.3	21.0	30.0
cool	2.7	22.2	5.6	33.3	4.9	20.0
Average	20.7	24.3	22.8	47.4	22.4	29.6

behavior for a moment.

Results: Table 4 shows the student's impression for each group. The data were collected from student's responses to the check list form including 45 good items and 32 aversive items selected from the free descriptions on the instruction by this system before.

A very few items show the differences both between groups a and b and between groups a and c. Only one item, i.e., ugly in the former case and 2 items, i.e., impressive and modern in the last case show more than 20 percent difference.

Fig. 3 IMAGE OF LECTURE IN STUDENTS



In contrast, as Figure 3 shows the differences of percentage between groups b and d are found to be more than 20% in many items.

And Table 5 shows the results of the assessment for lecture in each group. It is similar to the above results, excluding the difference between Groups a and c in several items. The difference between groups were not found in the student's performance for answer to a short quizz.

From these results, the following concluding remarks could be gained.

Table 5 Results of Assessment of lecture for each item in each Group

Item / Group	a	b	c	d
n	55	25	16	15
Content of Lecture				
1. Amount of Content	-.02	.17	.13	-.14
Procedure of Lecture				
2. Essence First	.24	-.08	-.33	-.44
3. Full of Variety	.63	.64	.33	.60
4. Intuitive	.45	.44	.20	.06
Student's Impression of Lecture				
5. Speed	.16	.31	.14	-.12
6. Powerfulness	.25	.09	-.07	-.36
Effectiveness of Lecture				
7. Comprehension	.39	.38	.54	.13
8. Formation of way of Thinking	.33	.46	.62	.13
9. Development of Motivation	.42	..25	.31	.00
10. Delight in Learning	.41	.29	.31	.20

Figure means the average score for each item to which were given +1 for larger, 0 for neutral and -1 for smaller value.

1) The face of a professor is assumed to be important to make a lecture more attractive and more impressive.

2) It might be possible to utilize one channel communication system with a video-memory unit in order to send the scene of instruction without reducing the attractiveness and good impressions.

3) However, a professor should ask the students to answer the questions and to discuss the problems to each other in Group c.

(4) The Effects of Micro-Teaching on the Improvement of Student Teacher's practice teaching behaviors.

Since 1971, in the technical high school attached to the Institute situated at 30 minutes distance, the Micro-Teaching has been conducted to improve the teaching behaviors in student teachers who would be secondary school teachers for science, mathematics and engineering. In 1974, when the video-scope and TV cameras were introduced to the classroom mentioned above, the Micro-Teaching could have been executed also in the campus of Tokyo Institute of Technology.

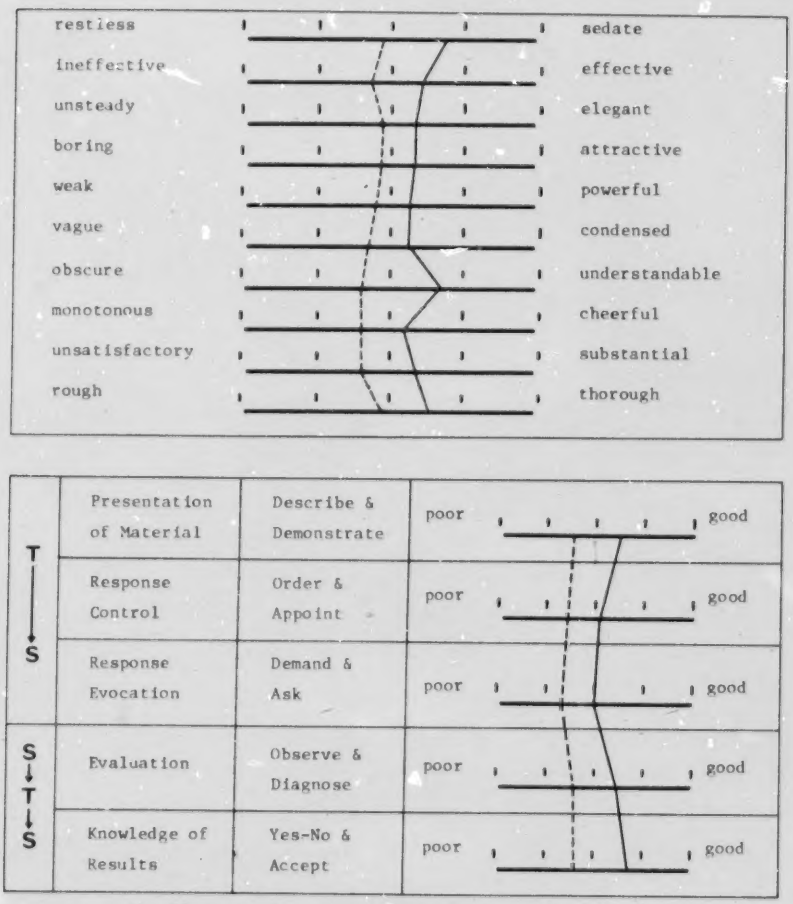
Purpose: The aims are to examine the effectiveness of Micro-Teaching on the improvement of teaching behaviors in student teachers and to find out better use of VTR communication system in teacher training course.

Procedure: The student teachers are divided into 3 groups, according to their own choice.

Group I --- Those who can see their own TV images together with other student teachers after the first practice of specific teaching skills for 3 minutes, will be pointed out the good and wrong teaching behaviors by other student teachers and professional school teachers, and could have an occasion to think of the way they improve their own behaviors.

Group II --- Those who have no chance to see their own TV images, but can point out the good and wrong teaching behaviors in other student

Fig. 4 IMPROVEMENTS IN PRACTICE TEACHING THROUGH MICRO TEACHING



* S stands for Student; T stands for Teacher

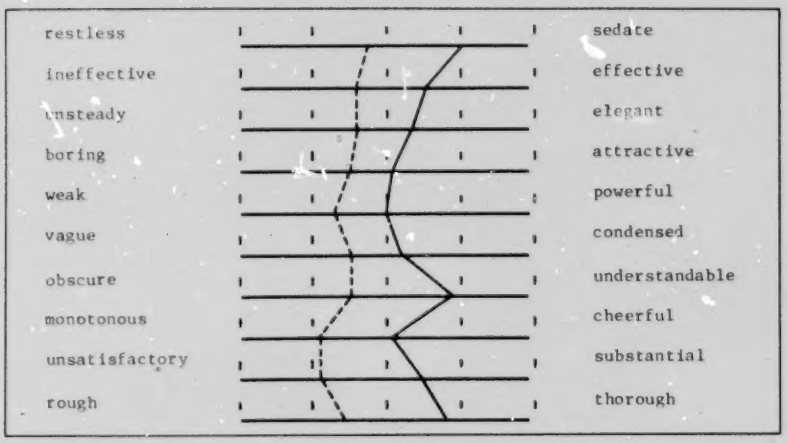
teachers, discuss on their improvement and could think of the way they improve their own behaviors in reflecting with other student teachers' behaviors.

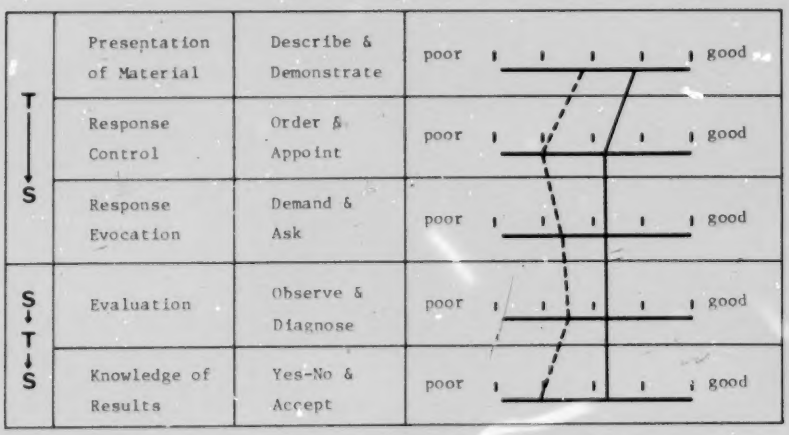
Group III --- Those who repeat the practice about half an hour after the first practice and have no chance to see any teaching behavior of themselves and of other student's teachers.

In every group, the teaching behaviors are evaluated after each practice in form of Figure 4 by about 10 professional teachers and about 15 student teachers. In Group I and II, the student teachers who just

Fig. 5 IMPROVEMENTS IN PRACTICE TEACHING THROUGH MICRO TEACHING

EFFECTS IN EACH GROUP GROUP 2





------ the first trial ——— the second trial

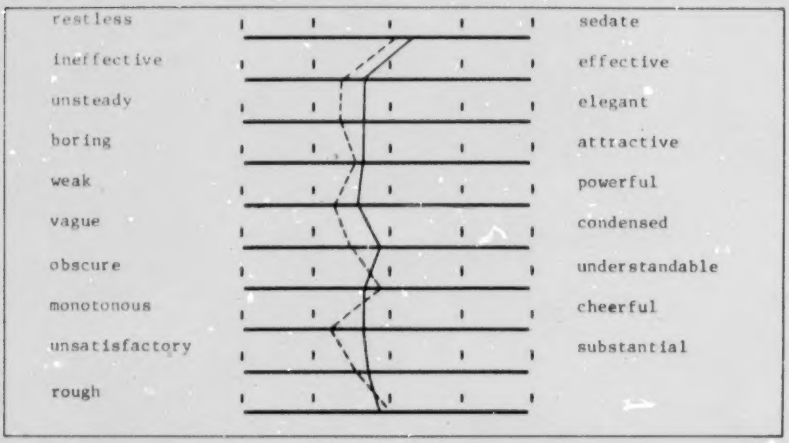
* S stands for Student; T stands for Teacher

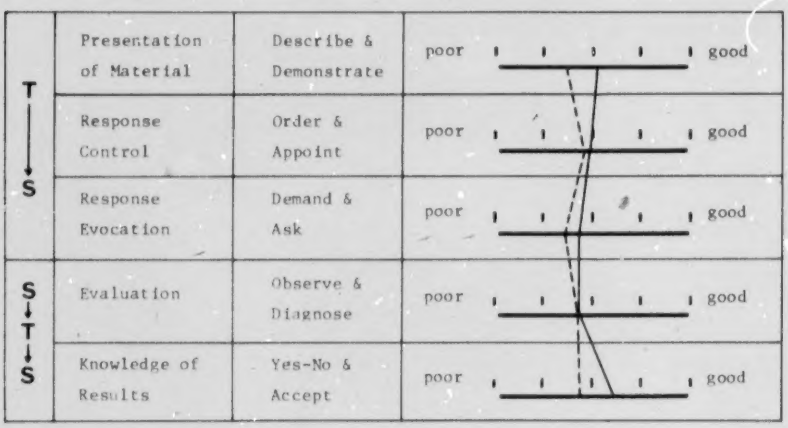
finished the practice in front of assumed secondary school students can ask the latter to express the results of their assessment of teaching behaviors by pushing the corresponding button in response analyzer just in 2 items and are shown the graph of their own results.

Results: Figure 5 shows the effectiveness of 2 types of Micro-Teaching, i.e., Group I seeing their own TV images and Group II seeing the others' TV images. It shows that the student teachers could improve drastically their teaching behaviors. In contrast, there seems to be nothing improved in Group II (Fig. 6).

Fig. 6 IMPROVEMENTS IN PRACTICE TEACHING THROUGH MICRO TEACHING

EFFECTS IN EACH GROUP GROUP 3





----- the first trial ——— the second trial

* S stands for Student; T stands for Teacher

The statistically significant improvement might not be simply due to the repetition of practice, but to experiences which student teachers could have in observing and inquiring into the good and wrong teaching behaviors successively by means of VTR, and in examining exactly the result of evaluation of their own behaviors by professional teachers.

The difference of improvement is not found between Group I and II as far as these items are concerned. However, some of the student teachers in Group I told that they felt a great deal of gain from self-confrontation. (Figure 4).

In order to improve the teaching behaviors, it is very desirable to give everyone the experience for self-confrontation if time allows, but when many student teachers should be trained in a limited period, it could be sufficient for some of them to see the behaviors in other student teachers.

The Micro-Teaching are assumed to be useful not only for the training of student teachers, but also for the improvement of teaching behaviors in professors in universities. It is necessary to set up a systematic way of conducting micro-teaching for university professors because the number of students in universities and colleges has been increasing year by year.

4. Conclusion

The application of technological innovation in education is much advanced in the primary and secondary school level in Japan. The systematic approaches in teaching-learning processes have been introduced to advanced schools scattered nation wide. However, in colleges and universities, these application are not yet enough studied even in Tokyo Institute of Technology which is assumed to be one of the most advanced in this field. Particularly these studies including the analysis of professor's behaviors in the instructional processes and the proposal for the improvement of their behaviors are quite important and necessary in colleges and universities, but they will encounter with many difficult problems in Japan.

(1) Lack of interest and desire for the improvement of the educational methods among university professors, particularly among amny professors of educational research.

In Japan, many researchers have more interests in the historical and philosophical studies on education than in empirical studies on

education. Even in the latter, most of them have much interests in purely academic, scientific and experimental studies on educational processes than in practical studies on improvement of education by means of educational technology.

On the other hand, though some of researchers and professors in the field other than educational research have been also undertaking studies on education of their own field, these studies are not highly evaluated in the academic societies and remains to be irrelevant to the promotion of their status.

(2) The difficulty of the academic researches.

Since studies are related with quite complicated and uncontrolable conditions, it is difficult to conduct purely scientific and experimental study. Moreover, since it should be probibited to establish such conditions as inducing a disadvantage for students, the comparative conditions could not often be set up in actual educational processes.

(3) Shortage of the budget.

The budget has been scarcely provided to education but much to academic research field, particularly in highly privileged colleges and universities. However, recently it is delightful in Japan that the National Science Fund has provided much money to studies on the application of the technological innovations in education for these several year and the Ministry of Education has established the Educational Technology Center in Teacher Training Colleges for these three years.

It is expected that these trends would continue in future, and stimulate the technological innovation in higher education of Japan.